Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

R21
3-54
of-1

July 1959 ARS-33-54

1959

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

SCREENING TESTS OF COMPOUNDS FOR TOXICITY TO THE SOUTHERN POTATO WIREWORM

By F. P. Cuthbert, Jr., and W. J. Reid, Jr.,
Entomology Research Division[1]/

In 1957 and 1958 various compounds were tested in the laboratory against larvae of the southern potato wireworm (Conoderus falli Lane). The tests were undertaken following the development of resistance to aldrin, chlordane, dieldrin, and heptachlor in populations of this wireworm at Charleston, S. C. (Reid and Cuthbert 2), and Hastings, Fla. (Norris 1).

The insecticides were mixed for 15 minutes with screened, air-dried soil in a small electric pebble mill. Emulsifiable concentrates, wettable powders, and water-soluble compounds were mixed with enough water so that 25 ml. of liquid was added to each quart of soil. Compounds that were insoluble in water or could not be satisfactorily formulated were added to the soil in 1 or 2 ml. of acetone. The soil mixtures were held in polyethylene bags until used.

Approximately 40 ml. of the treated soil was placed in each of twenty 3-ounce salve cans within 24 hours (4 hours for volatile materials) after the insecticide was added. One field-collected larva was immediately put in each can. A small cube of potato was provided as food in 1957, a kernel of boiled corn in 1958. As far as possible, equal numbers of larvae of different sizes were exposed to each dilution of the insecticide, but at times some sizes were difficult to find in the field. These tests showed little effect of size on the larvae's reaction to insecticides, although the very small ones appeared to be slightly more susceptible. DDT and parathion standards were included at least once every 3 weeks, and untreated checks each week. The cans were examined 3 to 5 days after the tests were started and at 2-week intervals thereafter. The numbers of dead or moribund larvae were recorded at each examination and food and water added as needed. All tests were terminated at the end of 9 weeks.

Compounds concerning which sufficient information was available were tested initially at the highest dosage considered practical for field use. Dosages were calculated as the equivalent number of pounds per acre to a depth of 6 inches. Other organic-phosphorus compounds

---

1/ In cooperation with the South Carolina Agricultural Experiment Station.

were usually tested at an initial dosage of 2 pounds and chlorinated hydrocarbons at 20 pounds per acre.

The compounds tested, the dosages, and the mortality of the wireworms at various intervals, adjusted for the untreated checks, are shown in table 1. The chemical names of the new proprietary materials tested precede the table.

The toxicities of DDT at 20 pounds and of parathion at 1/4 pound per acre were used as a basis in evaluating results of these tests. DDT had previously been tested in field plots and was used extensively for wireworm control in commercial Irish potato plantings in Charleston County during the spring of 1957. At 20 pounds per acre it was only moderately effective but was relatively long lasting. Parathion proved quite toxic at dosages as low as 1/2 pound per acre in the laboratory tests in 1957. It was therefore given field-plot trials in the fall of that year and used in commercial plantings in the spring of 1958. A dosage of 2 pounds per acre gave good to excellent field control that season. However, by the end of the year it became evident that the short residual effectiveness of parathion results in certain problems in its use for wireworm control.

Only a few of the compounds tested in the laboratory proved to be as toxic as parathion to the southern potato wireworm. American Cyanamid 18133 was the most effective of the organic-phosphorus compounds, being approximately twice as toxic as the same dosages of parathion. Several of the lower dosages were intended to be identical to those of parathion, but the sample was later found to contain less active ingredient than first reported. Diazinon, Thimet, and Union Carbide 8305 were about equal to parathion, and Hercules 3004 was slightly less effective. At comparable dosages methyl parathion was inferior to parathion.

None of the chlorinated hydrocarbons were as toxic as parathion. The most promising material was Shell SD-4402, which was 5 to 10 times as effective as DDT.

Aldrin, dieldrin, and lindane were more toxic than DDT and gave high kills at relatively high dosages. However, aldrin and dieldrin at dosages normally used as soil insecticides have become ineffective in several areas in the Southeast, and lindane cannot be used in potato plantings because of the danger of off-flavor in the tubers.

1-Fluorochlordene was more toxic than DDT at the 20-pound dosage, but it showed no toxicity at 2 pounds. Chlordane, endrin, methoxychlor, Perthane, TDE, and Dilan were approximately equal to DDT.

The 2,4-dimethylbenzyl ester was the most toxic of the esters of chrysanthemumic acid (including barthrin). It was slightly more effective than DDT.

The nematocides D-D mixture, dibromochloropropane, Mylone, Vapam, and VC-13 showed considerable toxicity at one or more dosages. The experimental methods used probably were not well suited for testing the compounds that are essentially soil fumigants, such as D-D mixture and dibromochloropropane.

Literature Cited

(1) Norris, Dale M.
1957. Failure of soil insecticides to control the southern potato wireworm, Conoderus falli Lane. (Abstract) Bull. Ent. Soc. Amer. 3: 40.

(2) Reid, W. J., Jr., and Cuthbert, F. P., Jr.
1956. Resistance of the southern potato wireworm to insecticides. Jour. Econ. Ent. 49: 879-880.

Chemical Names of the New Proprietary Materials Tested

Am. Cyanamid 18133	O,O-diethyl O-2-pyrazinyl phosphorothioate
Am. Cyanamid 18706	S-(N-ethylcarbamoylmethyl) O,O-dimethyl phosphorodithioate
Bayer 23453	S-2-(ethylsulfinyl)ethyl O,O-dimethyl phosphorodithioate
Bayer 29759	5-(2-hydroxyethyl)tetrahydro-3-methyl-2H-1,3,5-thiadiazine-2-thione
Dibrom	1,2-dibromo-2,2-dichloroethyl dimethyl phosphate
General Chemicals 3562	diethyl 2-(1,1,3,3-tetrafluoro-2-hydroxy)-propylphosphonate
General Chemicals 3661	1,3-bis(methoxycarbonyl)-1-propen-2-yl diethyl phosphate
General Chemicals 3707	1,3-bis(methoxycarbonyl)-1-propen-2-yl dimethyl phosphate
Hercules 426	5-(dichloromethyl)-1,2,3,4,7,7-hexachlorobicyclo-[2.2.1]hept-5-ene
Hercules 2032	S-(O,O-diethyl phosphorodithioate) of p-oxathiane-3-thiol
Hercules 3004	diethyl 1-ethylthio-1-propen-2-yl phosphate
Hercules 3273	S-(O,O-dimethyl phosphorodithioate) of p-2-oxathiene-X-thiol
LS-3394	bis(tributyltin) ether
Monsanto CP 7769	hexaethyl (ethylthiomethylidyne)triphosphonate
Monsanto CP 10502	1-(dimethoxyphosphinyl)vinyl dimethyl phosphate
Monsanto CP 10516	1-(diethoxyphosphinyl)vinyl dimethyl phosphate
Mylone	3,5-dimethyltetrahydro-2H-1,3,5-thiadiazine-2-thione
Shell SD 3562	dimethyl 1-(dimethylcarbamoyl)-1-propen-2-yl phosphate
Shell SD 4092	1-benzyloxycarbonyl-1-propen-2-yl dimethyl phosphate
Shell SD 4239	1-p-chlorobenzyloxycarbonyl-1-propen-2-yl dimethyl phosphate
Shell SD 4402	1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanoisobenzofuran
Union Carbide 8305	P-chloro-5-methyl-P-thio-2,4,3-dioxaphosphabicyclo[4.4.0]decane
Vapam	sodium methyldithiocarbamate
VC-13	O-(2,4-dichlorophenyl) O,O-diethyl phosphorothioate

Table 1.--Toxicity of various compounds to larvae of the southern potato wireworm in laboratory cages

Compound	Formulation	Equivalent pounds of toxicant per 6-inch acre	Cumulative percent mortality[1] after--				
			3-5 Days	3 Weeks	5 Weeks	7 Weeks	9 Weeks
Aldrin	WP	6	15	65	83	88	94
Am. Cyanamid 18133	WP	20	100				
		10	100				
	EC	1.4	100				
		0.7	100				
		.18	100				
		.09	55	50	50	50	50
Am. Cyanamid 18706	EC	2	0	0	0	0	0
Barthrin	EC	5	10	29	46	44	38
Bayer 23453	EC	2	0	0	23	33	33
Bayer 29759	Acet. S	20	100				
		1	0	0	0	0	0
6-Bromopiperonyl chrysanthemumate	EC	5	5	12	31	44	38
Chlordane	EC	10	0	25	14	36	50
Chlorthion	EC	2	10	10	0	0	0
Cryolite	WP	100	0	0	0	0	0
D-D mixture	Tech.	20 gal.	76	75	78	78	83
		2 gal.	0	0	0	0	0
DDT	EC	40	70	94	93	100	
		20[2]	57	78	81	82	82
	WP	20	60	80	91	90	90
	EC	10	45	60	64	80	80
DDVP	EC	2	65	69	64	71	83
		0.25	0	0	0	0	10
Delnav (Hercules AC-528)	EC	2	0	5	5	5	6
Diazinon	EC	2	100				
		0.25	60	93	100		
		.12	0	0	0	0	0
Dibrom	EC	2	11	0	15	25	25
	WP	2	15	12	31	56	50
Dibromochloropropane	EC	1 gal.	75	100			

Table 1.--Continued

Compound	Formulation	Equivalent pounds of toxicant per 6-inch acre	Cumulative percent mortality[1] after--				
			3-5 Days	3 Weeks	5 Weeks	7 Weeks	9 Weeks
Dieldrin	WP	12	0	35	72	82	94
Dilan	EC	20	45	80	82	80	80
		2	0	0	0	0	0
2,4-Dimethylbenzyl chrysanthemumate	EC	10	40	95	94	94	94
		5	15	53	62	56	50
3,4-Dimethylbenzyl chrysanthemumate	EC	5	10	6	15	11	0
Dipterex	WS	2	35	28	20	14	36
Di-Syston (Bayer 19639)	EC	2	15	22	27	29	36
Endrin	EC	10	75	82	77	67	62
		2	5	12	28	36	36
Ethion	EC	2	5	32	42	35	31
1-Fluorochlordene	EC	20	40	100			
		2	22	7	0	0	0
General Chemicals 3562	EC	2	25	32	47	47	50
General Chemicals 3661	EC	2	5	16	21	12	12
General Chemicals 3707	EC	2	0	0	15	25	25
Guthion	EC	2	10	11	20	14	21
Heptachlor	EC	6	5	5	0	0	0
Hercules 426	EC	20	16	18	43	43	43
Hercules 2032	EC	2	55	61	61	67	67
Hercules 3004	EC	2	100				
		0.25	30	29	17	9	0
Hercules 3273	Acet. S	2	60	72	72	72	72
Lindane	EC	4	95	100			
		1	42	53	57	64	64
LS-3394	EC	20	0	5	0	5	0
		2	0	10	5	10	11
Malathion	EC	2	5	10	0	0	0

Methoxychlor	EC	40	35	94	100		
		20	5	58	62	75	82
		10	0	19	50	57	67
Methyl parathion	EC	2	90	100			
		1	60	75	78	76	76
		0.5	40	47	77	78	75
		.25	25	24	38	33	25
Monsanto CP 7769	EC	2	0	13	54	42	50
Monsanto CP 10502	EC	2	5	0	15	11	25
Monsanto CP 10516	EC	2	5	0	8	11	0
Mylone	WP	100	100				
		10	50	53	53	60	50
Parathion	EC	2	100				
		1	100				
		0.5	100				
		.25 2/	52	66	71	71	71
		.12	0	0	0	0	0
Perthane	WP	40	35	78	93	93	100
		20	71	88	87	93	92
		10	40	40	18	20	20
Phosdrin	EC	0.5	0	5	5	5	5
		.25	0	0	0	0	0
Phosphamidon	EC	2	0	0	0	0	0
Rotenone	WP	4	0	0	0	5	10
Sevin	EC	20	18	18	7	13	0
		4	0	0	0	0	0
Shell SD 3562	WS	2	14	11	11	17	17
Shell SD 4092	EC	2	0	33	46	50	50
Shell SD 4239	EC	2	0	0	0	0	0
Shell SD 4402	EC	10	100				
		2	65	84	84	85	81
		1	59	60	54	54	54
		0.25	0	0	0	0	0
Strobane	EC	40	0	30	47	58	58
TDE	EC	40	53	100			
		20	53	94	93	93	93
		10	0	19	43	57	75

U. S. DEPT. OF AGR. LIBRARY
BELTSVILLE BR.
LIBRARIAN
10-24-55 PLANT INDUSTRY STA.
33 BELTSVILLE, MD.

Table 1.--Continued

Compound	Formulation	Equivalent pounds of toxicant per 6-inch acre	Cumulative percent mortality 1/ after--				
			3-5 Days	3 Weeks	5 Weeks	7 Weeks	9 Weeks
Thimet	EC	2	100				
		1	100				
		0.25	50	67	64	80	80
		.125	30	30	42	39	15
Thiodan	WP	20	18	24	13	13	15
		4	5	0	0	0	14
Toxaphene	EC	40	15	39	27	21	21
Trithion	EC	2	0	0	0	0	8
		0.5	0	0	0	10	10
		.25	0	0	0	0	0
Union Carbide 8305	EC	.5	100				
		.25	50	75	64	70	70
		.12	5	15	10	6	0
Vapam	EC	20 gal.	100				
		2 gal.	15	24	60	50	50
VC-13	EC	25 gal.	100				
		2 gal.	100				
		0.5 gal.	50	95	100		

1/ Adjusted for untreated check.

2/ Standards, tested at least once every 3 weeks.